A framework for image analysis in plant breeding

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For quality of life

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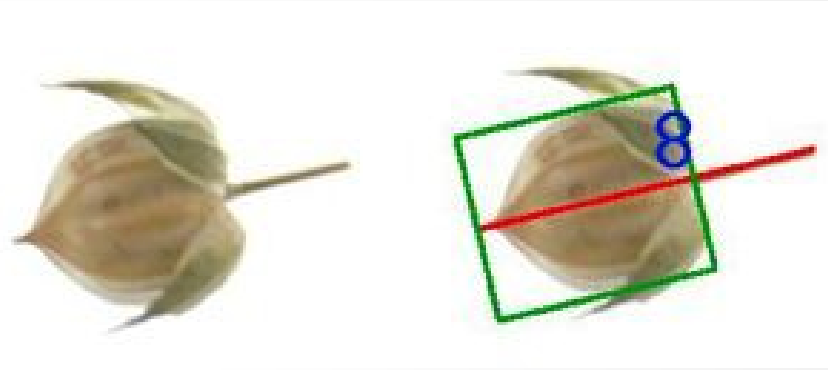
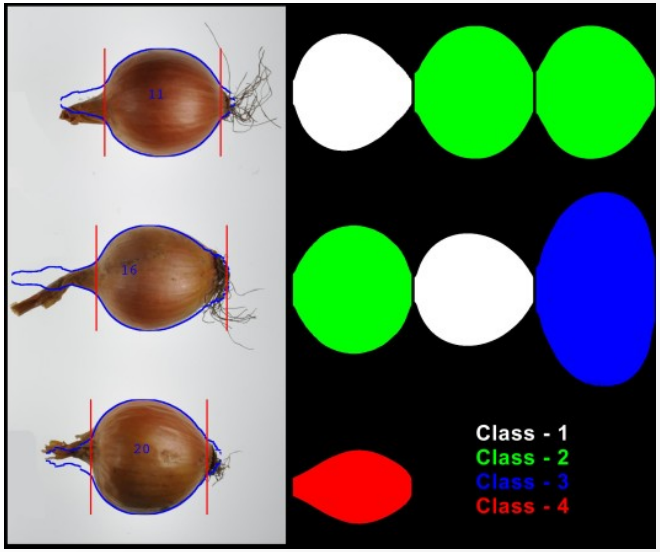
Image analysis in plant breeding

- Marker assisted breeding
- Markers:
  - Molecular
  - Biochemical
  - **Morphological**
- Shape, color and quantitative
- Tool for breeding

From melon to cucumber

Examples of image analysis used in plant breeding





An ImageJ plugin for plant variety testing Polder, G. , Blokker, G. , Heijden, G.W.A.M. van der (2012) In: Proceedings of the ImageJ User and Developer Conference 2012, 24-26 October 2012, Mondorf-les-Bains, Luxembourg. - : Centre de Recherche Public Henri Tudor, 2012 - p. 168 - 173.

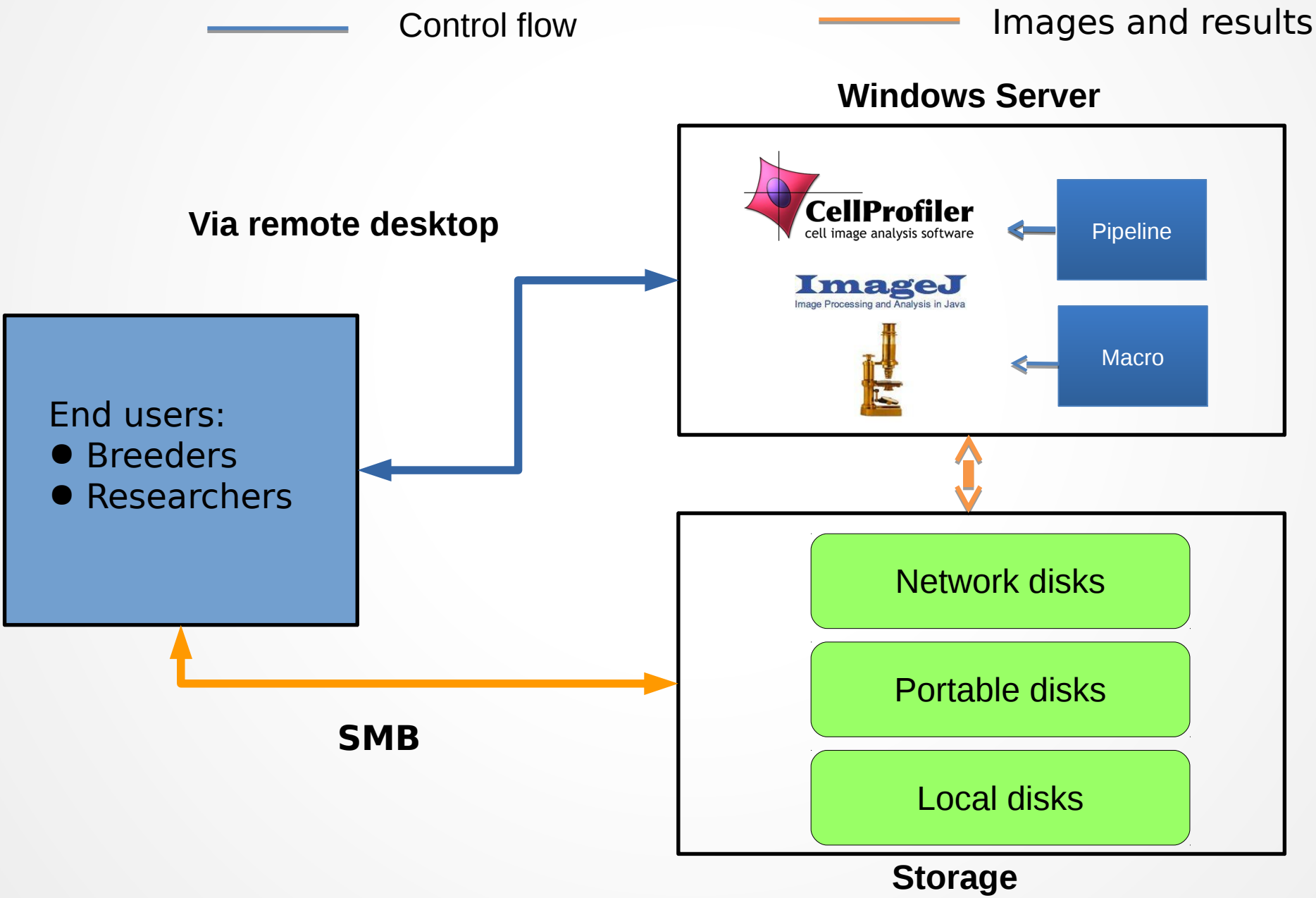
Existing practice of image analysis

Use of popular open source tools

CellProfiler
cell image analysis software

ImageJ
Image Processing and Analysis in Java

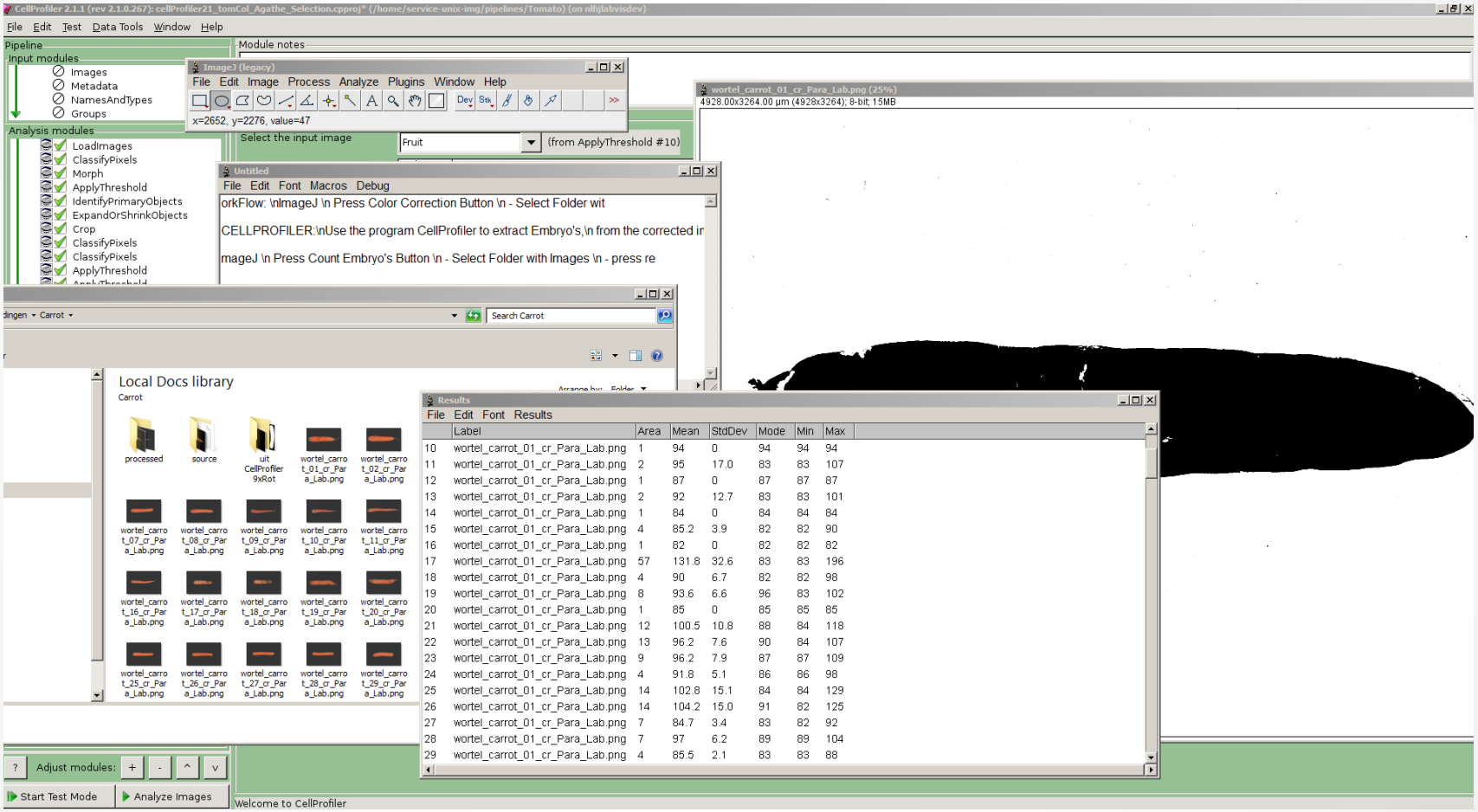
Current work flow of image analysis



Current challenges

- Increasing size of datasets
- Data storage decentralized
- Little structure in metadata:
  - Identification
  - Results
- Quality assurance
- User interface

Current challenges

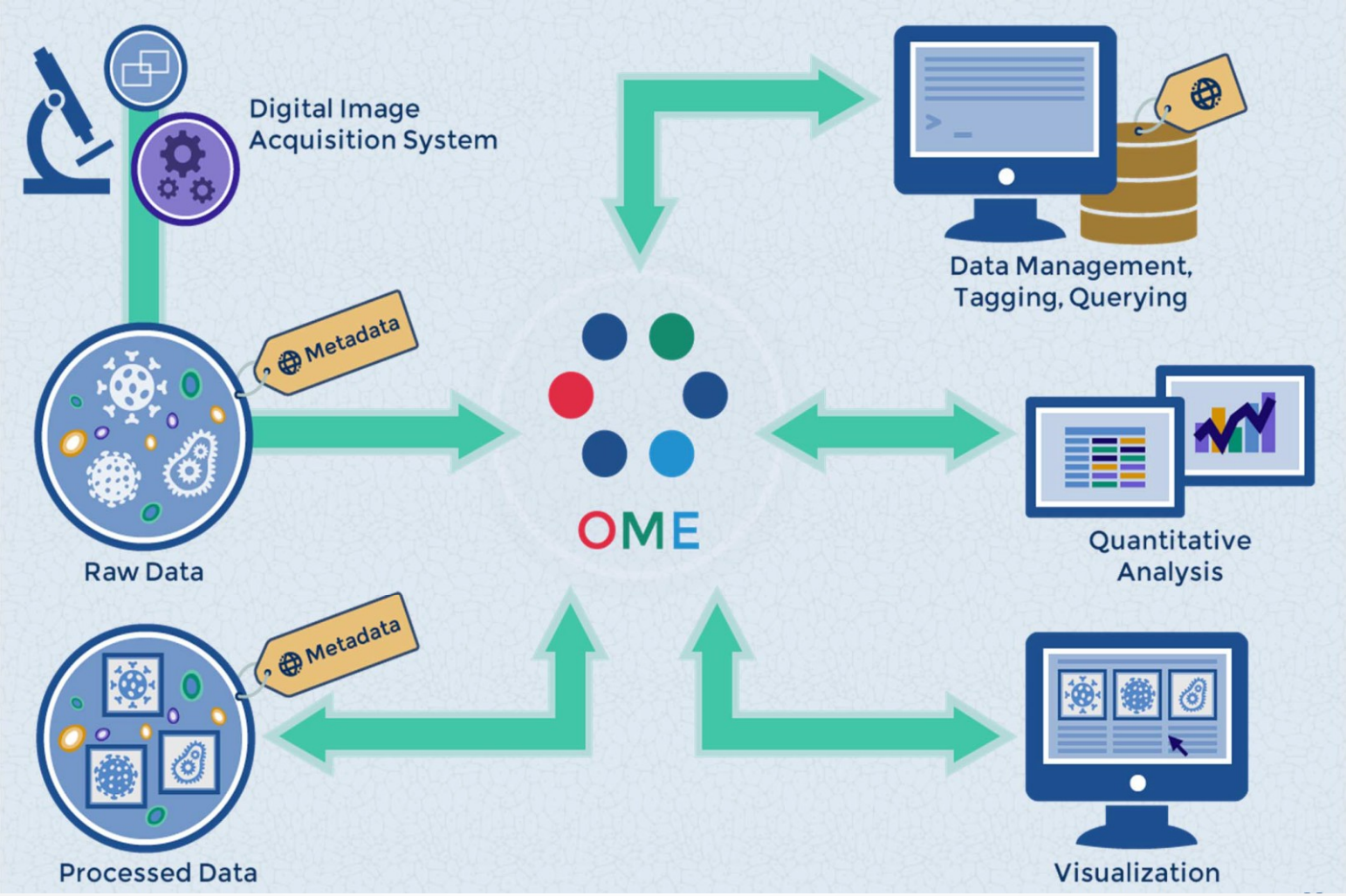


Difficult end-user experience

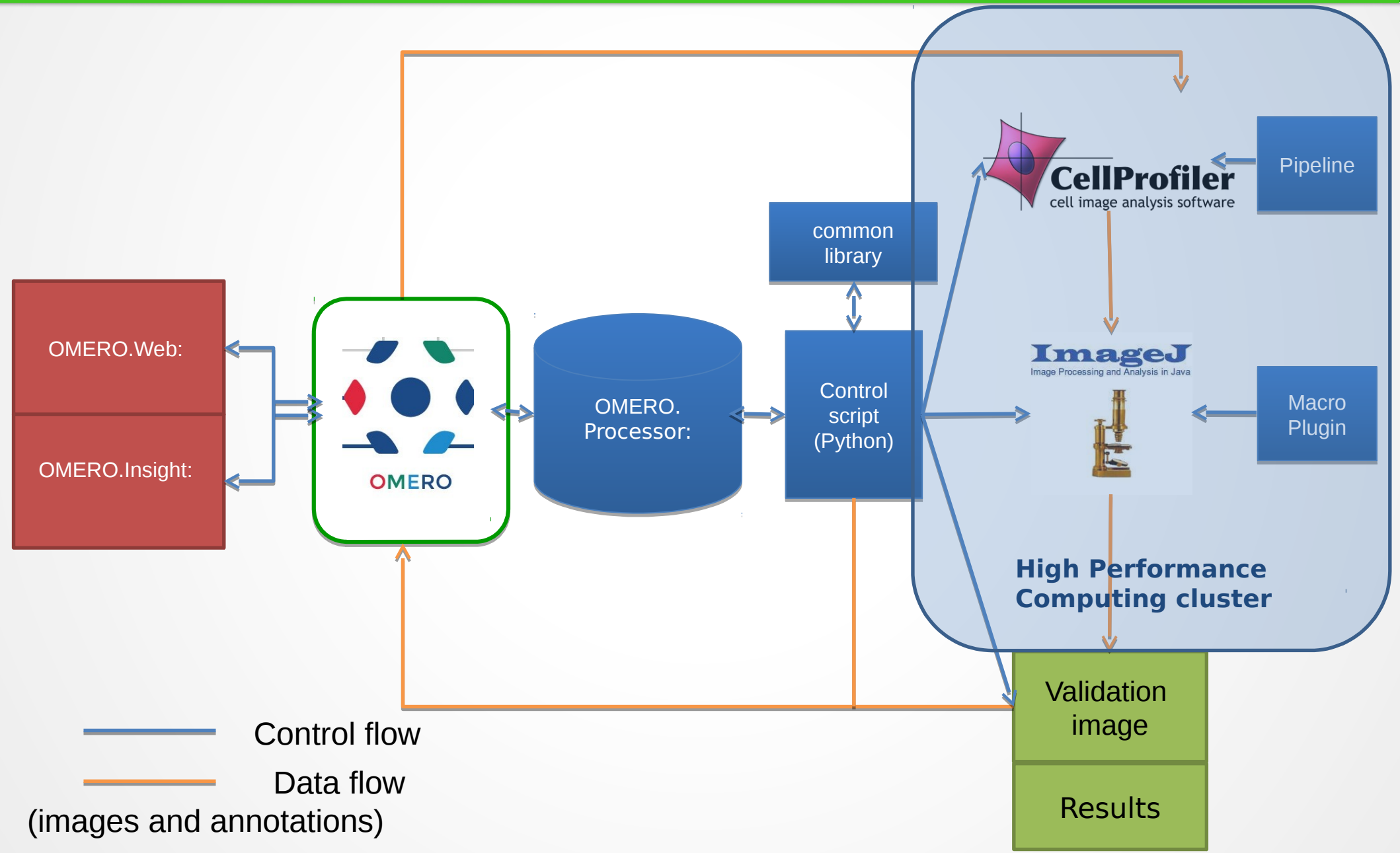
Aim of project

- Improve end-user experience
- Store metadata of results and images
- Improve data storage capabilities
- Improve performance scalability
- Improve quality assurance

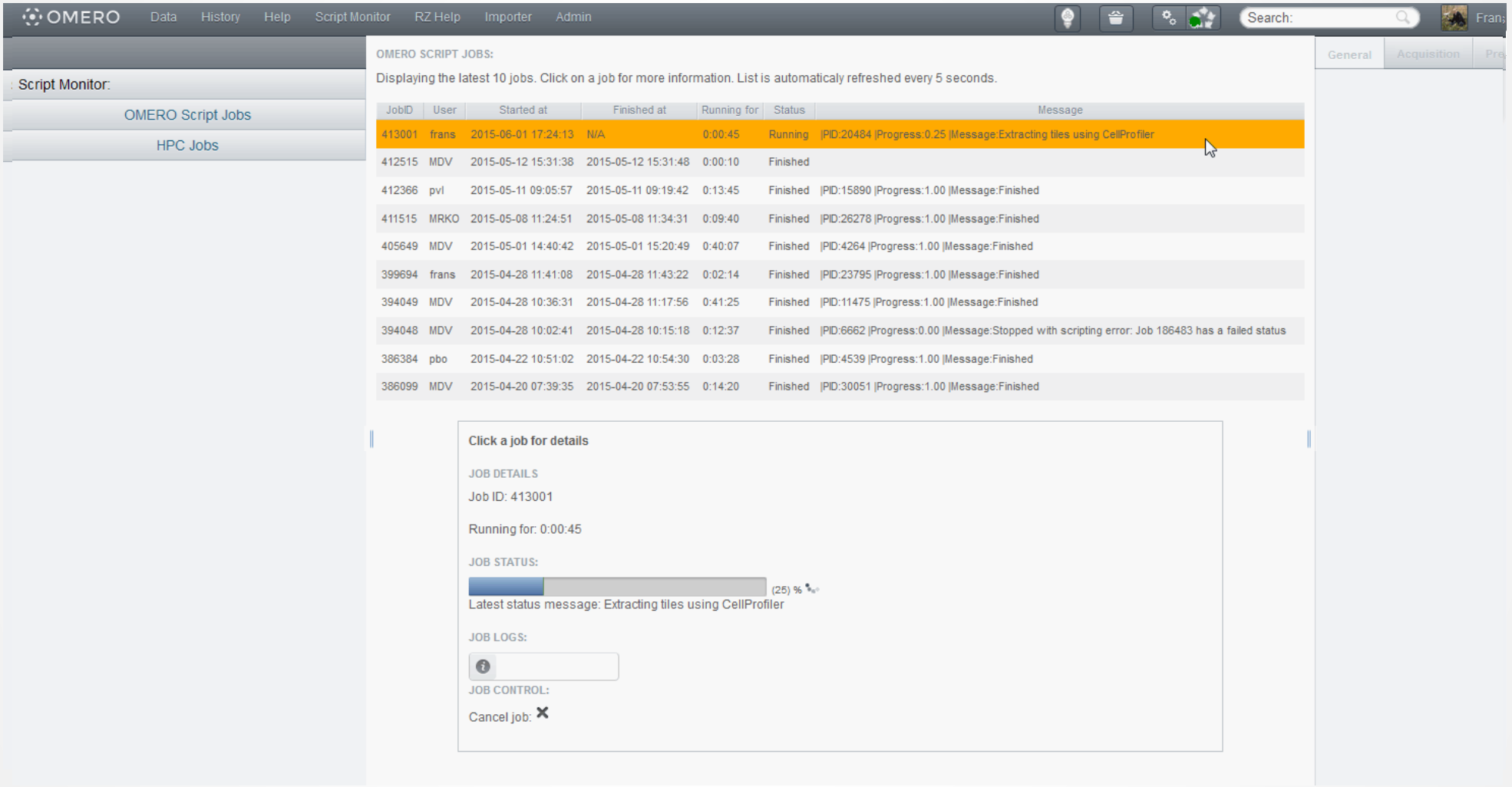
Discovering OMERO



Pipeline of image analysis

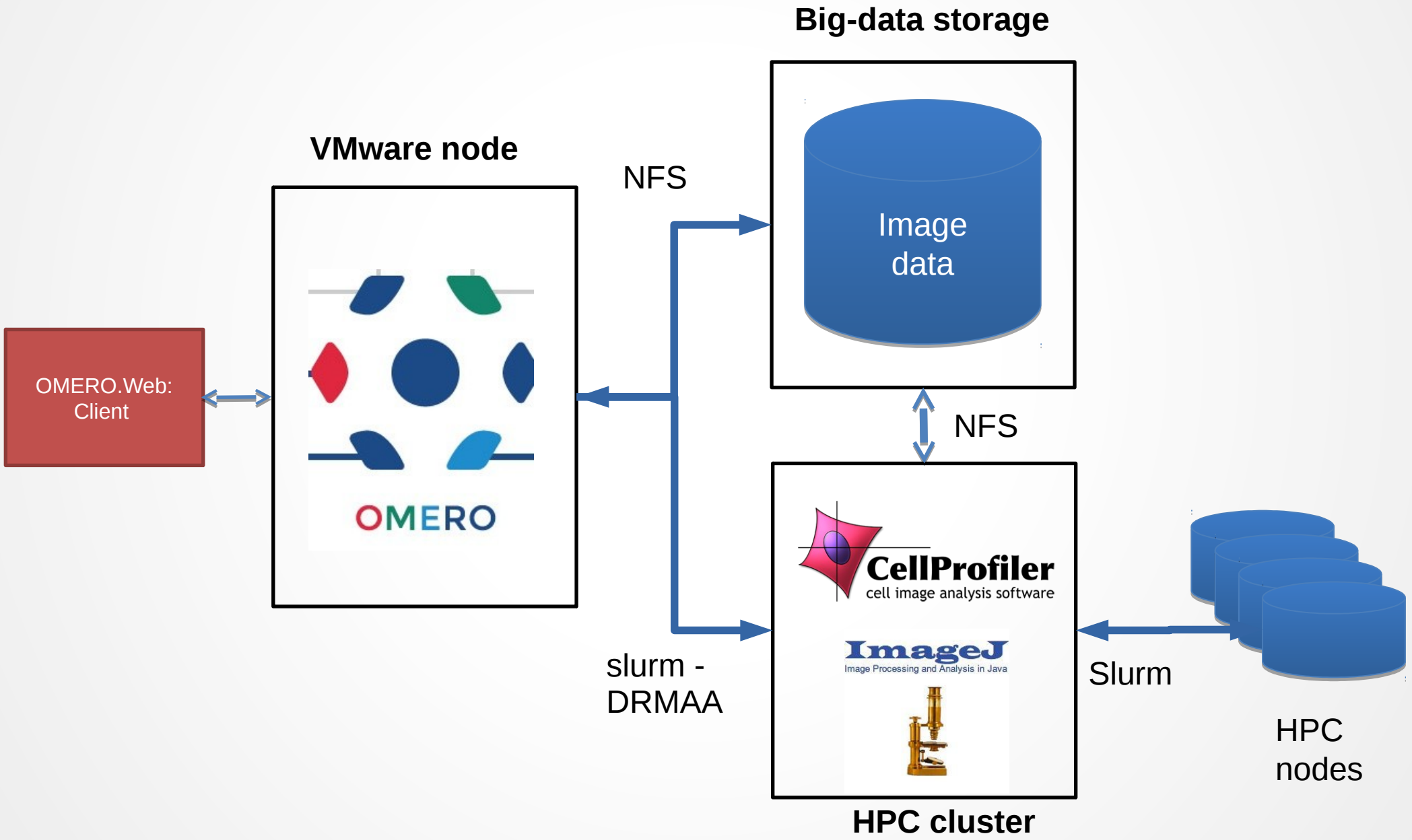


Progress monitoring



Making use of jobHandle.setMessage()

Infrastructure of the framework



Acquisition of images into OMERO

- Identification metadata
- Barcode scanner

Quality Assurance

- Version control (SVN)
- Doc generation (Sphinx)
- Automated testing
  - Functional and acceptance (Python nose)
- Nightly tests. Reporting to monitoring system (PRTG).
- Testing environment
- Monitoring system availability and regressions

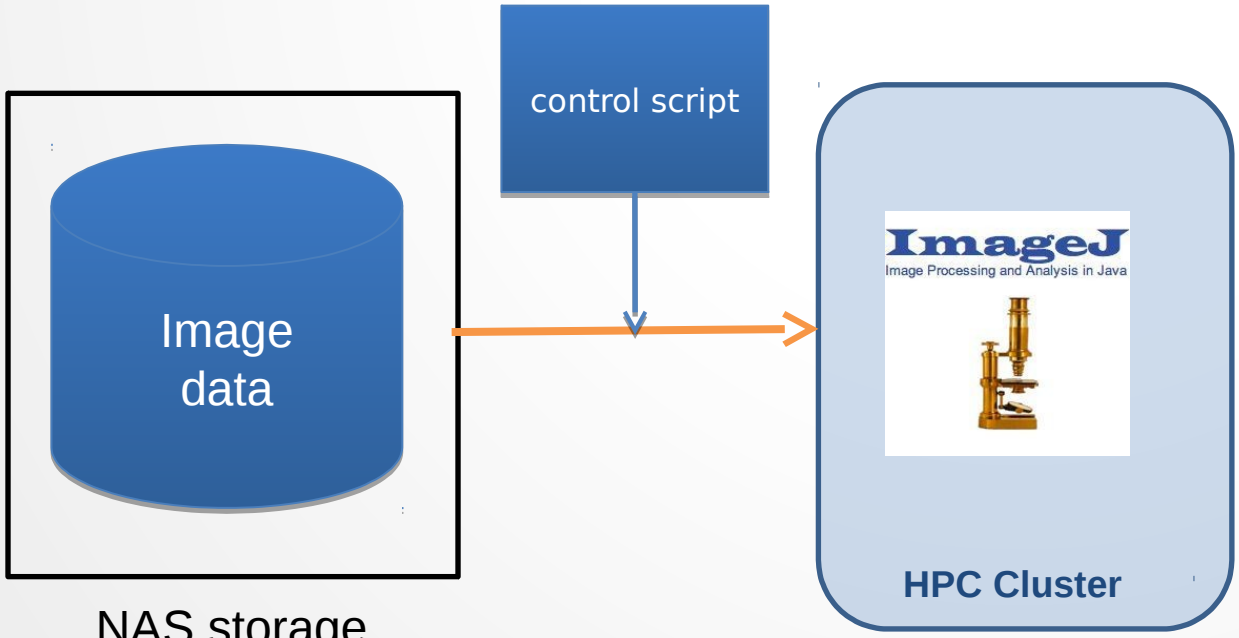
Test case: Shape parameters of carrot

- Determine different shape parameters
- Crop selection

Step 1: Acquisition and calibration

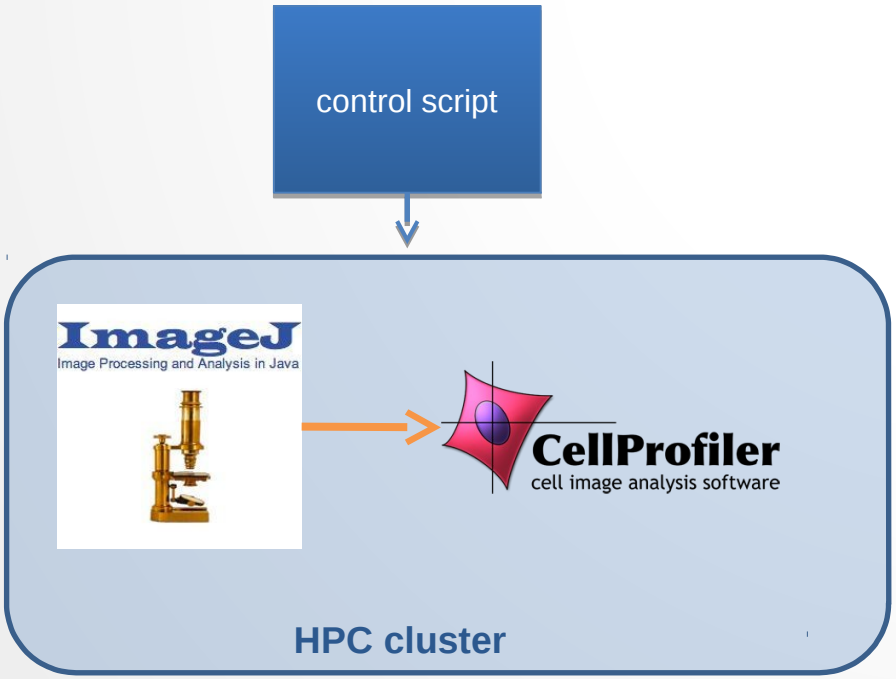
- Batch-wise import
- Color and light

Before



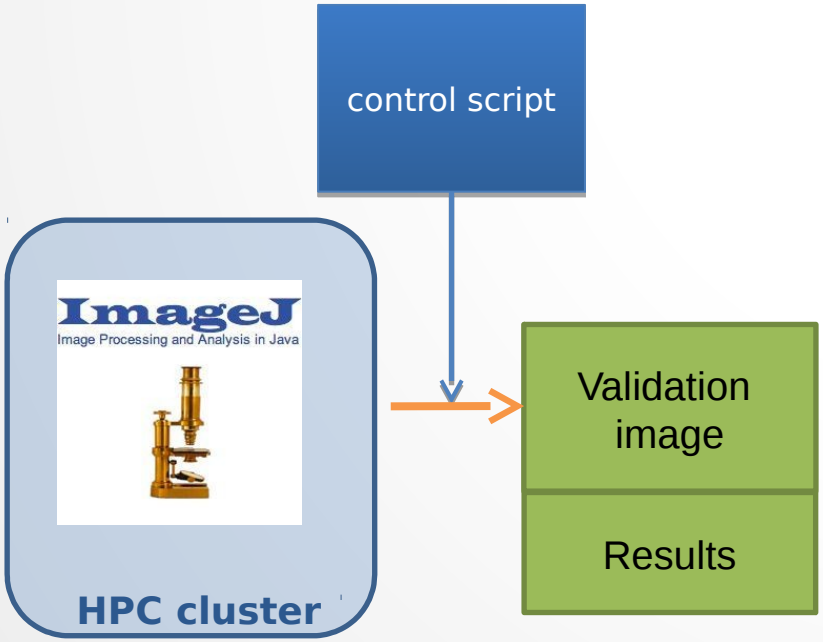
Step 2: Classification and segmentation

- Crucial step
- Time-consuming calculations



Step 3: Measurement of parameters

- Results in CSV format
- FileAnnotation

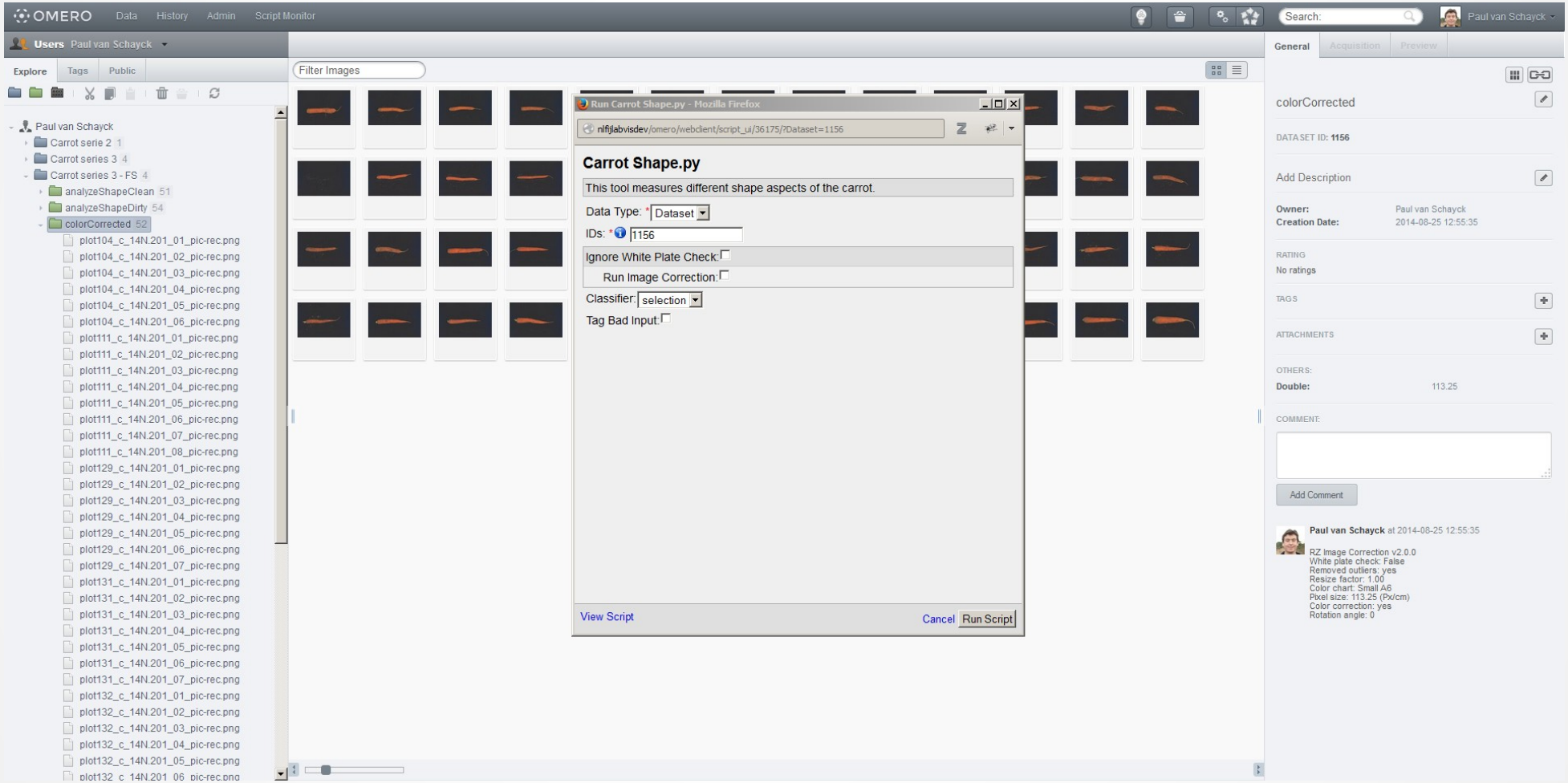


Conclusions of the carrot test case

- Further implementation:
  - Validation
  - Integration

Conclusions

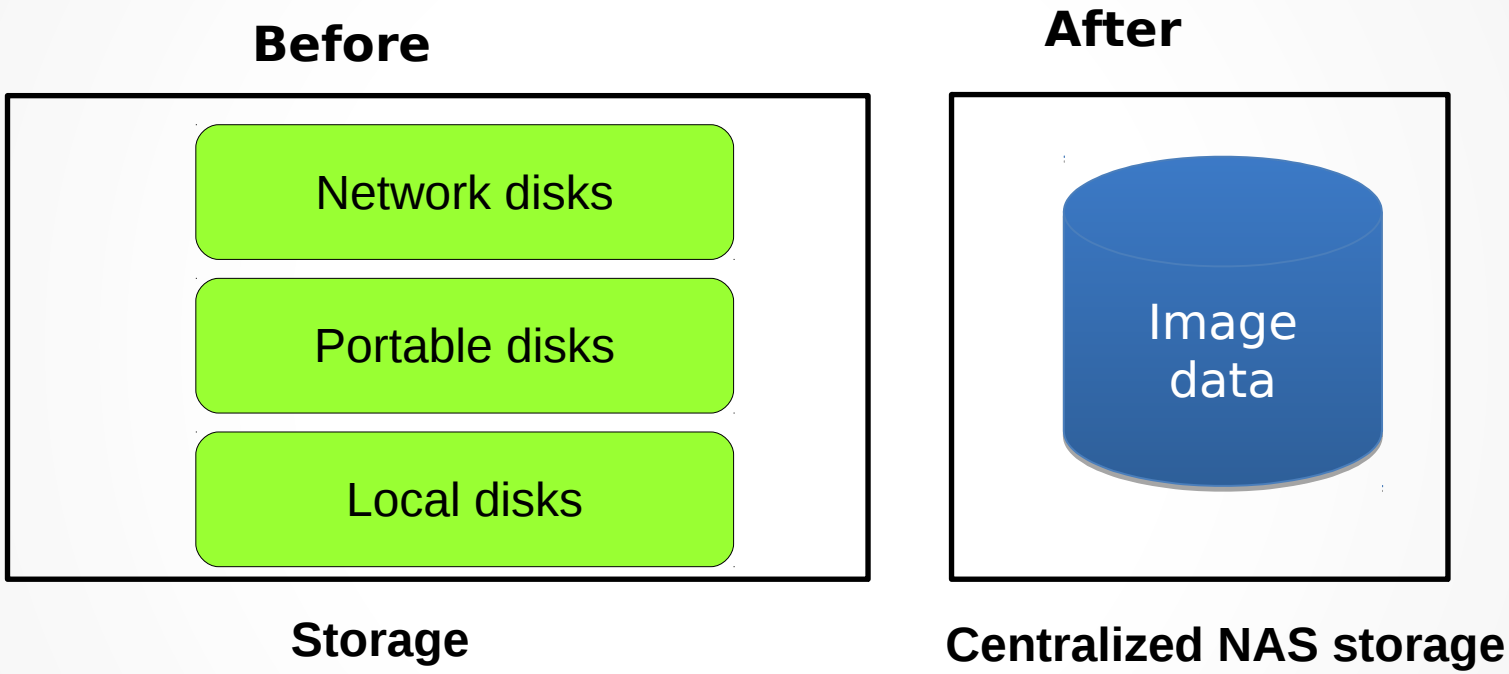
- Improved end-user experience



Improved end-user experience

Conclusions

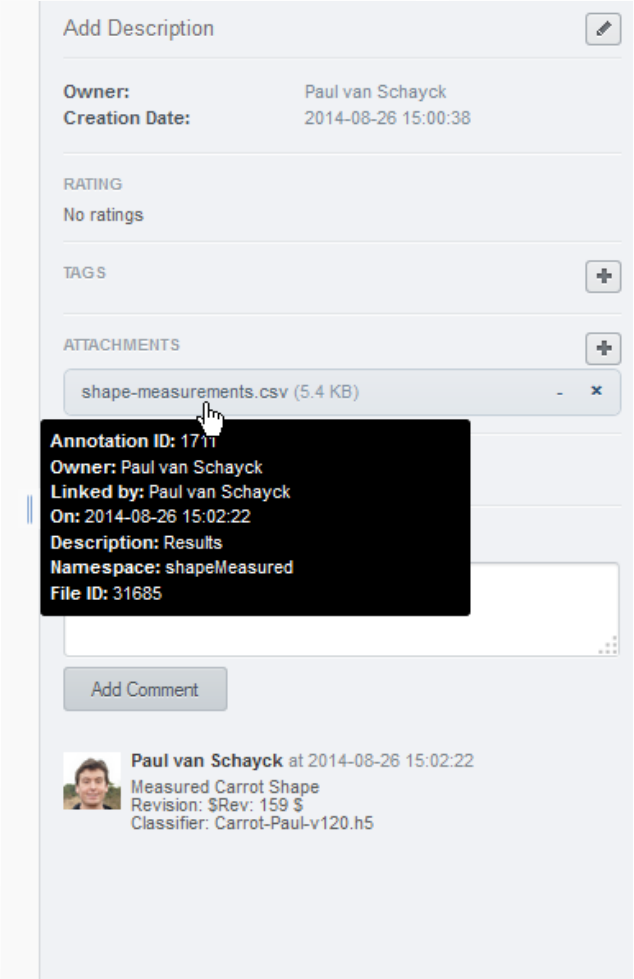
- ✓ Improved end user experience
- ✓ Centralized storage



Centralized storage

Conclusions

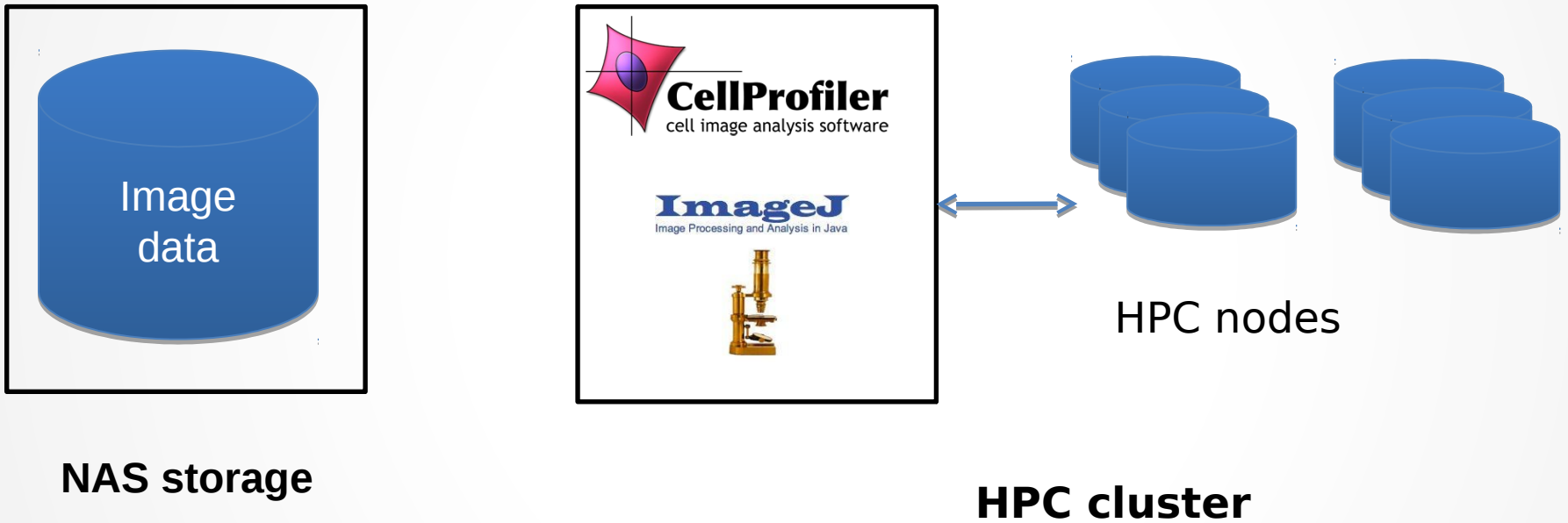
- ✔ Improved end user experience
- ✔ Centralized storage
- ✔ Storage of metadata



Storage of metadata

Conclusions

- Improved end user experience
- Centralized storage
- Storage of metadata
- Performance scalability

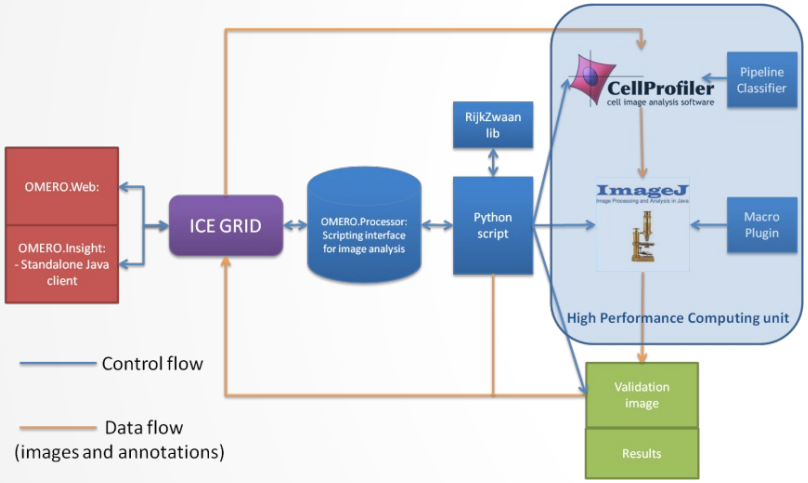


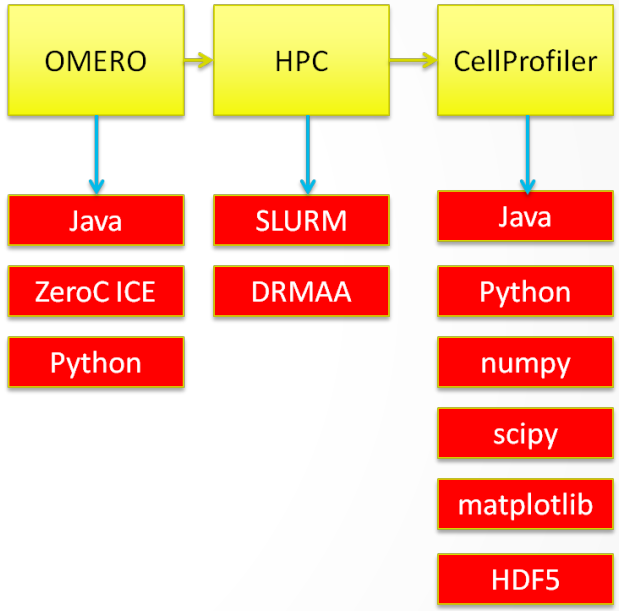
Performance scalability

Conclusions

- ✓ Improved end user experience
- ✓ Centralized storage
- ✓ Storage of metadata
- ✓ Performance scalability
- ✗ Complexity for developers
- ✗ Software dependencies

At the cost of





More steps required by developers

Software dependencies

Conclusions

- ✓ Improved end user experience
- ✓ Centralized storage
- ✓ Storage of metadata
- ✓ Performance scalability
- ✗ Complexity for developers
- ✗ Software dependencies
- ✓ Quality assurance

Quality assurance

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For quality of life

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